DOCUMENT RESUME

ED 239 605 IR 010 968

AUTHOR	Levine, Janice Resnick
TITLE	Microcomputers in Elementary and Secondary Education: A Guide to the Resources.
INSTITUTION	ERIC Clearinghouse on Information Resources, Syracuse, N.Y.
SPONS AGENCY	National Inst. of Education (ED), Washington, DC.
REPORT NO	IR-65
PUB DATE	Aug 83
CONTRACT	400-77-0016
NOTE	70p.
AVAILABLE FROM	Information Resources Publications, 030 Huntington Hall, Syracuse University, Syracuse, New York 13210 (IR-65; $3.75 plus $1.50 shipping and handling).
PUB TYPE	Reference Materials - Bibliographies (131) -- Information Analyses - ERIC Information Analysis Products (071)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Books; Clearinghouses; *Computer Assisted Instruction; *Computer Literacy; *Computer Programs; Databases; Elementary Secondary Education; Equipment Evaluation; *Microcomputers; Nonprint Media; Periodicals; Professional Associations; Publishing Industry; *Reference Materials; Textbooks
IDENTIFIERS	*Courseware Evaluation

ABSTRACT

Designed for use by educators and school media specialists, this resource guide identifies some of the major sources of information dealing with the use of microcomputers for instructional purposes in elementary and secondary education. It is also intended to serve as an ongoing guide to the location of up-to-date microcomputer information for educators interested in keeping abreast of the field. A brief evaluative description is provided for each of the resources, which are presented in 22 major categories: associations, resource centers, and user groups; information clearinghouses; bibliographies; introductory guides to educational computing; resource guides; directories; indexes and abstracts; periodicals; databases; dictionaries and encyclopedias; yearbooks; conference proceedings; biographical sources; statistical sources/government documents; hardware information resources; software/courseware resources; textbooks; popular and notable books in the field; evaluative articles -- the state-of-the-art"; sources of book reviews; nonprint materials; and book publishers. Fifteen references are listed, and additional information for each of the resources listed is provided in the bibliography of books, articles, periodicals, and associations which concludes the guide. (BBM)

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MICROCOMPUTERS IN ELEMENTARY AND SECONDARY EDUCATION: A GUIDE TO THE RESOURCES

by James Bozeck Deane

ERIC
An Information Analysis Product
1983

IR010968

MICROCOMPUTERS IN ELEMENTARY AND SECONDARY EDUCATION:

A GUIDE TO THE RESOURCES

by Janice Resnick Levine

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August 1983

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This publication was prepared with funding from the National Institute of Education, U.S. Department of Education, under contract no. NIE-400-82-0001. The opinions expressed in this report do not necessarily reflect the positions or policies of NIE or ED.

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ACKNOWLEDGEMENTS

I would like to express my thanks to Marilyn Laubacher and B. J. Vaughn of the ERIC Clearinghouse on Information Resources staff for their advice and encouragement when I was compiling the resources for this publication. They know, as I do, that the list of microcomputer resources is never ending, and what a challenge it was to make some sense of order out of it! Thanks are also due to Barbara Minor for the editing and formatting of the final product. Without their help, this publication would never have reached fruition.

INTRODUCTION

In the last few years the microcomputer, also known as the home computer or personal computer, has burst onto the educational scene. Elementary and secondary school educators, administrators, and school media specialists are faced with the challenges and issues of the use of microcomputers in education. Prior to 1978, computers had been used for instructional purposes mainly in the secondary schools, via terminals connected to large-scale computers at remote sites. Although the history of the use of computers in education goes back almost twenty years, the microcomputer did not appear until recently. First produced in 1975, this relatively inexpensive, small, self-contained, yet powerful machine, made computers much more accessible financially to elementary and secondary schools. With the invention of the microcomputer, the field of educational computing began to truly blossom, and with it came an incredible proliferation of educational computing magazines and books.

To begin to understand the world of educational computing, it is important to become familiar with some of the terminology. Computer-Based Education (CBE) and its synonym, Computer-Assisted Learning (CAL), were the terms used for many years to describe the use of computers for educational purposes. Within Computer-Based Education there are two subsets, CAI (Computer-Assisted Instruction) and CMI (Computer-Managed Instruction). Computer-Assisted Instruction refers to a system whereby a student interacts with a computer and receives individualized instruction which can be in such forms as drill, practice, games, graphics, and/or simulations. Computer-Managed Instruction refers to a system whereby the computer aids teachers in managing their instruction by performing such tasks as record keeping, marking tests, and word processing. Today, the terms Educational Computing and Instructional Computing are used interchangeably to describe the use of microcomputers in education, and are more commonly used terms than Computer-Based Education, with the latter often referring to the use of large, mainframe computers. CAI and CMI are both systems used on microcomputers, and the terms are still utilized.

A computer system--for our purposes, a microcomputer system--consists of both hardware and software/courseware. Hardware, i.e., the physical equipment which makes up a computer system, includes such components as the keyboard, screen, and printer. Software, also known as programs, is the set of instructions which tell the microcomputer what to do. "Educational software is usually accompanied

by a range of additional materials, including teachers' manuals, ditto sheets, workbooks, and tests. This total package of programs and additional materials is often called courseware."[1] Computer programs are written in computer languages; the main ones used for microcomputers in education are BASIC, Pascal, and Logo. Logo, a computer language developed for elementary school children, is another term which is frequently mentioned. A few resources to explore in order to become acquainted with Logo include special Logo issues of Classroom Computer News, April 1983 (1)* and BYTE, August 1982 (2), and Tom Lough's article, "Logo--Discovery Learning with the Classroom's Newest Pet" (3).

Another phrase in frequent use is "computer literacy." Parents are demanding computer literacy for their children, and many educators agree that all precollege students should become computer literate. Computer literacy, however, means different things to different people, and no definition has yet gained widespread acceptance. One brief definition of computer literacy is the ability to understand computers, including their capabilities and limitations, as well as to know how to use them. For more information specifically about computer literacy, an excellent place to start is ERIC's free four-page fact sheet, Computer Literacy (4), prepared by Marilyn Laubacher in December 1982. Produced at the ERIC Clearinghouse on Information Resources, this fact sheet includes an introduction to computer literacy and an extremely useful list of resources. (See #27 in bibliography for the address.)

Another source to consult is Computer Literacy: Issues and Directions for 1985 (5), edited by Robert J. Seidel, Ronald E. Anderson, and Beverly Hunter, 1982. Based on the conference on "National Goals for Computer Literacy in 1985" held in Reston, Virginia, in December 1980, it discusses the history, goals, directions, and issues of computer literacy. Though slow reading at times, it is nonetheless a thought-provoking book, especially useful for those involved in developing a computer literacy curriculum.

While we are discussing terms, it is important to note that in the recent educational literature the terms "computer" and "microcomputer" are often used interchangeably in titles. Many

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* A number in parentheses following the citation of an information source indicates the number under which additional information on that source is given in the bibliography.

books and articles which refer to "computers" in their titles are primarily, if not completely, concerned with microcomputers, as will become apparent as educational computing publications are discussed in the pages which follow.

In the field of educational computing there are a number of people who are considered the "pioneers." Patrick Suppes, at the Institute of Mathematical Studies in the Social Sciences at Stanford University, "might almost be considered 'the father of computer assisted instruction.'"[2] He was involved in some of the earliest projects in Computer-Assisted Learning in the 1960s. Others who came into the forefront in the late 1960s or early 1970s include Arthur Luehrmann, presently the head of Computer Literacy, Incorporated; Seymour Papert, Director of the MIT Logo Group at the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology; Thomas Dwyer, computer scientist and educator at the University of Pittsburgh; Alfred Bork at the University of California at Irvine; and David Moursund at the University of Oregon.

Arthur Luehrmann has been an "outspoken advocate of computer literacy"[3] since the early 1970s, and in 1981 he founded Computer Literacy, Incorporated, an organization devoted to promoting computer literacy. First with Dartmouth College's Kiewit Computation Center, and later as director of the Lawrence Hall of Science's computer science programs, he has been promoting educational computing at all levels for over a decade. Seymour Papert is internationally known for his development of Logo, a computer language designed for elementary school children. He has been involved with Logo since the early 1970s at the Artificial Intelligence Laboratory at MIT. His book, Mindstorms: Children, Computers, and Powerful Ideas (128) is one of the notable books in the field of educational computing. Thomas Dwyer, involved with a project at the University of Pittsburgh on applications of computing in the teaching of mathematics at the secondary school level, has also been in the forefront of the push for computer literacy for over a decade. Alfred Bork, professor of physics at the University of California at Irvine, has been applying CAI to the teaching of physics. David Moursund, another strong advocate of computer literacy, helped to found the International Council for Computers in Education, and is presently the editor-in-chief of the Council's journal, The Computing Teacher (68), as well as being a professor at the University of Oregon in the Department of Computer and Information Science and the Department of Curriculum Instruction.

Newer names in the field include such people as Ronald E. Anderson and Kenneth E. Brumbaugh at MECC (the Minnesota Educational Computing Consortium); Judith Edwards-Allen, the director of MicroSIFT, a software clearinghouse at the Northwest Regional Educational Laboratory in Portland, Oregon; and Beverly Hunter, senior staff scientist at the Human Resources Research Organization in Alexandria, Virginia. So many educators and computer scientists are becoming involved in the educational computing field that it is impossible to give credit to everyone in this review of the literature.

The number of microcomputers found in the schools is increasing at an incredible rate. The number of microcomputers available for instructional use by public school students tripled between the fall of 1980 and spring 1982, according to a follow-up survey conducted by the National Center for Education Statistics.[4] New educational applications for microcomputers are emerging at a steady rate. Microcomputers are continually being refined, with new models appearing every year. Their cost is decreasing, while their capabilities are increasing. To support the rapid increase in the number of microcomputers in the schools, more and more software and courseware are appearing on the market. The software and courseware being offered are for all types of students, in all curriculum areas, at all levels from kindergarten (K) through grade 12. "Literally thousands of people are trying out new ideas, developing new curricula, and carrying on research."[5] It is very difficult to keep up with new developments in a field that is changing so quickly.

Accompanying the growth in the field of instructional computing is an overwhelming amount of literature, including periodicals and books. The purpose of this book is to identify some of the major sources of information dealing with the use of microcomputers in elementary and secondary education. Its focus is on the instructional rather than the administrative uses. It is hoped that educators and school media specialists will thus have a good starting point for locating the latest information on instructional computing.

The school media specialist has an important role to play in this area. School media specialists are often overseeing and coordinating the use of microcomputers in the schools. The centralization of equipment and software in the school media center increases its accessibility, and the school media specialist is an important resource person to consult for information on microcomputer software, books, and computer literacy programs.

The primary purpose of this book is not merely the provision of a list of actual resources in educational computing. It is intended, as well, to be an ongoing guide to the location of up-to-date microcomputer information for educators striving to keep abreast of this ever-changing field. It is thus very important to note that the resources included in this book are a selective, rather than a comprehensive list, and items were chosen for their high quality and currency. Information resources have been subdivided into specific categories and numbered. The numbers in parentheses in the text refer to those items in the bibliography at the end.

ASSOCIATIONS, RESOURCE CENTERS, AND USER GROUPS

There are many places one can turn to for information on educational computing, and it is often hard to distinguish between associations, organizations, and other types of groups involved with microcomputers in education. Many of the groups listed here have publications, workshops, and/or conferences that are worth checking out. For a more complete, annotated listing of associations, resource centers, and user groups than is possible here, consult the 1983-84 Classroom Computer Learning Directory (51), or Coburn et al.'s Practical Guide to Computers in Education (38). Reading one or more of the educational computing magazines on a regular basis will be a help in keeping up-to-date with the activities and latest publications of these groups. (See periodicals section.)

ASSOCIATIONS

Association for Computing Machinery (ACM) (16). The ACM deals with all aspects of computing. The two sections of ACM that deal specifically with instructional computing are the Special Interest Group on Computer Uses in Education-SIGCUE, and the Elementary and Secondary Schools Sub-Committee. Publications that may prove useful are Computing Reviews, the ACM Guide for Computer Science and Computer Applications Literature (both discussed in the Indexes section), and the ACM SIGCUE Bulletin, the latter being especially worthwhile for educators.

Association for Computers in Mathematics and Science Teaching (7). An educational organization for college and precollege mathematics and science teachers, this association deals specifically with the instructional uses of computers. Its publication is the Journal of Computers in Mathematics and Science Teaching (75).

Association for Educational Communications and Technology (AECT) (8). AECT is an organization of media professionals who seek to improve learning through the use of media and technology. They have a special task force on microcomputers and publish the journal, Instructional Innovator, which sometimes has feature articles on microcomputers.

Association for Educational Data Systems (AEDS) (9). AEDS is considered the "granddaddy" of the educational computing field. An international organization which provides a means for the sharing of information about educational data processing and computer technology, it covers all areas, including administration, instruction, and curriculum. Geared more to secondary than elementary education, AEDS sponsors workshops and programming contests for secondary school students, as well as an annual international convention. Publications of interest are the AEDS Journal and the AEDS Monitor, both of which often contain articles on instructional computing.

Association for the Development of Computer-Based Instructional Systems (ADCIS) (10). ADCIS, another international organization, seeks to advance research on and applications of computer-based instruction and management, promote the exchange of information, and reduce redundant activities among developers of CAI materials. Its members are from all levels of education. One of the oldest groups of computer-using educators, ADCIS has various special interest groups that would be of interest to K-12 educators and school media specialists, e.g., those dealing with the handicapped, elementary-secondary education, health education, home economics, and music education. Publications of interest are the ADCIS Newsletter, which reports on ADCIS activities, and The Journal of Computer-Based Instruction, a scholarly journal devoted primarily to the publication of research studies. ADCIS also annually hosts a conference on computers in education.

International Council for Computers in Education (ICCE) (11). Founded in 1979, the ICCE has quickly become the largest national educational computing organization. One of the few educational organizations which are specifically geared to professionals at the precollege (K-12) level, ICCE's strength comes from the grass-roots support of its individual and organizational members. Its objectives include improving the instructional use of computers and helping both teachers and students to become computer literate. Towards the latter goal, ICCE has produced a series of well-written, practical booklets and resource guides dealing with educational computing, including The Teacher's Guide to Computers in the Elementary School, and A Parent's Guide to Computers in Education. They also publish the journal, The Computing Teacher (68).

National Association for Educational Computing (NAEC) (12). The NAEC is a brand new educational computing association whose goals include the following: to serve as a national forum for the discussion of important issues in the field of educational computing, to endorse model curricula and disseminate information about their implementation, and to unify local, regional, and limited purpose groups under a single organization. Membership is open to those at all levels of education from preschool to college level. Since this is a new organization, it is hard to predict how effective it will be at achieving its goals, and how it differs in orientation from the ICCE. NAEC is setting up a National School Curriculum Center for Educational Computing at Iona College (31).

National Council of Teachers of English (NCTE) (13); **National Council of Teachers of Mathematics (NCTM)** (14); **National Council of Social Studies (NCSS)** (15); **National Science Teachers Association (NSTA)** (16). Each of these organizations geared to a specific subject specialty is concerned to some extent with microcomputer applications, and periodically publishes articles in its journals dealing with microcomputers. Most of them have also published some materials on educational computing.

Young People's Logo Association (YPLA) (17). The YPLA is a new organization for young people (under eighteen) and others who share the common goal of making the personal computer a creative learning center for all people. Their monthly publication is the Turtle News. The YPLA also has a software exchange program for its members, and has begun to publish a series of books on Logo.

INFORMATION ON RESOURCE CENTERS

Though this publication is primarily concerned with resources on microcomputers found in print and such nonprint sources as films and filmstrips, one should not overlook the various resource centers and advisory services designed to assist educators with instructional computing information, training, and planning. For an annotated listing of resource centers one can consult Coburn et al.'s Practical Guide to Computers in Education (38, pp.218-220), or the 1983-84 Classroom Computer Learning Directory of Educational Computing Resources (51).

Throughout the United States there are regional educational research and development laboratories and information exchanges that promote school improvement through their research, development, and information dissemination activities. Many of these institutions are publishing useful materials in the educational computing field, some of which are included in the pages which follow. Many also publish newsletters that often include tidbits of information on microcomputers. The 1983-84 Classroom Computer Learning Directory of Educational Computing Resources (51) includes listings of most of these institutions in the "Local and Regional Resources" section. A few worth noting are the Appalachia Educational Laboratory (18), the Northeast Regional Exchange (NEREX) (19), the Northwest Regional Educational Laboratory (NWREL) (108), and the Southwest Educational Development Laboratory (SEDL) (20).

Four examples of very effective, nationally known resource centers are the EPIE Institute (21), the Minnesota Educational Computing Consortium (MECC) (22), the Microcomputer Resource Center (23), and the Technical Education Research Center (24).

The EPIE (Educational Products Information Exchange) Institute (21) is the country's only educational consumer advocacy group that gathers and disseminates descriptive and analytical information on instructional materials, equipment, and systems. From October to June they publish two monthly newsletters, the EPIEGRAM: Materials and the EPIEGRAM: Equipment, as well as publishing quarterly EPIE Equipment Reports and EPIE Materials Reports. These publications identify inferior, unsafe, or questionable products, including educational software and hardware. The new MICROgram,

however, now seems to include most of their reporting on hardware and software.

The EPIE Institute and the Consumers Union have recently begun to sponsor the Consortium for Quality in Educational Computing Products. The consortium's goal is to actively promote the highest quality in educational microcomputing products and practices. It publishes a monthly newsletter, the MICROgram, from October through June, which can be ordered separately, or can be found in each issue of the magazine The Computing Teacher (68). The newsletter deals with concerns and recommendations about hardware and software products. The Consortium has also begun a product evaluation program called PRO/FILES that provides consumers with evaluations of microcomputer hardware and courseware. (PRO/FILES will be discussed in more detail in the hardware and software sections of this book.)

MECC, the Minnesota Educational Computing Consortium (22), was one of the first statewide instructional computing networks. It coordinates and provides computer services for all the public schools and colleges in Minnesota. Best-known outside of the state for its high quality educational software, MECC also provides in-service training for educators, materials for conducting this training, and curriculum guides, as well as providing assistance through their newsletters. USERS, a bimonthly instructional newsletter listing available materials, and DATALINE, their organizational newsletter, are available upon request, though there may be a small fee for non-Minnesota residents.

MECC recently developed two training courses. The first is a how-to, hands-on course for teachers that helps them decide when and where computer-aided instruction is most appropriate, and how to select courseware that best fits teacher and student needs. The second is a course for administrators, teachers, and media center personnel involved in planning a district's educational computing budget. MECC has also developed a Computer Courseware Review Form that is available free upon request.

The Microcomputer Resource Center (23) at Columbia University in New York conducts seminars and workshops on curriculum materials, as well as field-based training for the use of computers in the classroom. It is also a clearinghouse for hardware and software information.

The Computer Resource Center of the Technical Education Research Center (TERC) (24) in Cambridge, Massachusetts, also provides teachers with information on microcomputer hardware and software. Sample microcomputers and educational software are available for inspection and use at their facility. The Computer Resource Center also conducts workshops on classroom computer use. A clearinghouse for information about computer use in special education has recently been established at TERC, and workshops on that topic are also being offered. The Computer Resource Center has produced several worthwhile publications on educational computing that will be discussed in the pages which follow. Hands On, their quarterly newsletter, provides up-to-date information on developments in educational computing, and is available for a fee.

INFORMATION ON USER GROUPS

Many educational computing user groups have been set up recently to serve as sources of information exchange, assistance, and sometimes even software exchange. Names and phone numbers of the group found in a particular locale are usually available from a local computer store. Some user groups geared to owners of specific brands of microcomputers rather than to education can also be good sources of information. The most comprehensive list of educational computing groups, by state, is found in the 1983-84 Classroom Computer Learning Directory (51). Two other helpful listings of educational computing user groups are found in the appendix of Katherine Clay's new book, Microcomputers in Education: A Handbook of Resources (47), and the article, "Electronic Learning's Second Annual Survey of States--State User Groups," published in the November/December 1982 issue of Electronic Learning (25).

INFORMATION CLEARINGHOUSES

The Educational Resources Information Center (ERIC). ERIC--the Educational Resources Information Center--is a national information system sponsored by the National Institute of Education (NIE) of the U. S. Department of Education. ERIC consists of sixteen information clearinghouses located throughout the country, each dealing with a

different area in education. The clearinghouse that deals most specifically with general educational applications of microcomputers is the ERIC Clearinghouse on Information Resources (ERIC/IR) (27), located at Syracuse University. The ERIC/IR Clearinghouse, like the other clearinghouses, collects and indexes documents and journal articles, which are then cited in either ERIC's Current Index to Journals in Education (CIJE) (56) or Resources in Education (RIE) (62). Both are discussed in more detail in the section on indexes.

The Clearinghouse on Information Resources has been publishing a series of invaluable free two- to seven-page bibliographies and guides to resources on microcomputers, e.g., the one on computer literacy that was mentioned in the introduction was compiled in December 1982. Two more have come out since then--one entitled Information Resources on Microcomputers: A Sampling of the ERIC Database (28), and another worthwhile resource guide, Microcomputers: Some Basic Resources (29), both compiled by Marilyn Laubacher. Another source of information is the Clearinghouse's semiannual bulletin, the ERIC/IR UPDATE. Though not solely devoted to microcomputers, the newsletter usually contains information on some of the latest journals, databases, ERIC documents, software directories, and other publications. This bulletin can be obtained free of charge upon request.

For information on educational applications of microcomputers in specific subject areas such as science, reading, social studies, or mathematics, the subject-specific clearinghouses should be contacted. The ERIC Clearinghouse on Elementary and Early Childhood Education (ERIC/EECE) (30), for example, produces some materials on educational computing. They are now publishing a bimonthly newsletter, MicroNotes on Children & Computers. The newsletter will feature reports on how computers are being used to teach children, as well as news on computer-related publications and conferences. It is available on a subscription basis.

For further information on ERIC's services and descriptions of all of ERIC's clearinghouses, contact the ERIC Processing and Reference Facility (26) in Bethesda, Maryland.

The National School Curriculum Center for Educational Computing (31). "Iona College, in cooperation with the National Association for

Educational Computing, has agreed to sponsor the National School Curriculum Center for Educational Computing, as of Spring, 1983. The Center has been designed to collect, classify, evaluate, and disseminate educational computing curriculum materials for teaching at all grade levels (nursery through post graduates), and in all subjects, fields or disciplines."[6] Check the periodical literature for the latest developments.

BIBLIOGRAPHIES

Since the purpose of this book is to provide the most up-to-date and useful sources of information, few bibliographies published prior to 1981 have been included. Rapid changes in the field are making some of the information published obsolete a year or two after it comes out, while other books and articles continue to be relevant, dependent on the topics covered. Bibliographies are published periodically in the various educational computing, microcomputing, and education periodicals. The Education Index (57) contains bibliographies which can be located under the headings "Computers-Bibliographies" or "Microcomputers-Bibliographies." In ERIC's Resources in Education (62) abstracts, it is frequently noted if a document includes a bibliography. Looking up "Bibliographies" in the Microcomputer Index (61) will also produce positive results. Many worthwhile bibliographies can also be found in the latest books being published on educational computing. So many books and journal articles have been written or revised in the past few years that the most recent bibliographies should be used when seeking out books and journal articles on microcomputers.

Several bibliographies have been published recently that are worth noting, including the two ERIC bibliographies just mentioned in the previous section. The Computing Newsletter has just published the sixteenth edition of its Annual Bibliography of Computer-Oriented Books (January 1983) (32). It includes a total of more than one thousand books from one hundred and seventy publishers. Books are separated into subject categories, type (e.g., reference, textbook, handbook), and style of presentation (e.g., programmed instruction, case study, narrative). Though not annotated, and not specifically geared toward educational computing, it is one of the most comprehensive listings of computer books available. It is important to note,

however, that the bibliography's aim is to be comprehensive and up-to-date, rather than selective, and books of lesser quality are also included.

Susan Friel and Nancy Roberts's "Computer Literacy Bibliography" (33), though published in 1980, is an important source to be aware of. More than seventy books and articles are listed and annotated. Friel and Roberts have pinpointed many of the books written on computing published up to 1980 that are of interest to educators.

Computer-Based Education: The Best of ERIC, June 1976-1982 (34), compiled by Keith A. Hall, is the update of a bibliography originally published in 1980. This annotated bibliography highlights ERIC documents and journal articles concerned with computer-based instruction. The original bibliography covered primarily instructional applications and research involving large computers. The update also includes more than 60 citations concerned with microcomputers and their applications, though its emphasis is still mainframe computers.

Ann Lathrop's annotated bibliography of "Recommended Books for Elementary and Junior High Library Media Centers" (35), published in November-December 1982, lists twenty-six books. The list includes books on computer literacy and introductory programming for elementary and junior high school students, and would be helpful to both teachers and school media specialists. Though Lathrop's list is selective, based on her own readings and reviews by writers she "knows and respects," it is one of the first attempts to highlight such books. Books included were published between 1976 and 1982, though very recent books are the most prevalent. Grade levels are also included, which is a strongpoint of the bibliography.

Miller's Microcomputers and the Media Specialist: An Annotated Bibliography (36) was published in 1981 by the ERIC Clearinghouse on Information Resources, and includes materials as recent as October 1981. Again, both school media specialists and teachers will find this bibliography useful. From its well-written, informative introduction to its list of journals at the end, it is a valuable source of information. Miller has compiled a selective bibliography of journal articles, ERIC documents, government documents, and books on such topics as hardware, software, educational applications, and computer literacy. Items are divided into nine sections by subjects. The main

weakness of the bibliography is the fact that some items are listed without sufficient information, e.g., full addresses, which would assist the user in obtaining those items easily.

INTRODUCTORY GUIDES TO EDUCATIONAL COMPUTING

Many introductory guides to the world of instructional computing have been published recently and new ones are constantly appearing. A sampling of these guides will be discussed in this section. Most have similar titles, but each is unique in its presentation, with a few topics included in each one which are not present in the others. Thus the guides complement each other, and one should choose the guide(s) that best fit one's information needs.

First in the Addison-Wesley series on Computers in Education, Peter Coburn et al.'s Practical Guide to Computers in Education (38), published in the summer of 1982, is one of the best available at the present time. Cohesive and practical (as its name implies), it covers all aspects of the field and is very readable. Subjects covered include a thorough general overview of microcomputer applications in the classroom, computer terminology (complete with photographs), and suggested procedures for selecting, evaluating, and purchasing microcomputers and software for school use. It is a step-by-step, illustrated, how-to guide, which is complemented by a glossary, bibliography, and a very valuable 37-page annotated resource section. No list of resources is ever comprehensive, but this book's coverage is impressive: it covers everything from resource centers to funding sources. Details about specific subject applications are not discussed since they will be covered in other books in the series, e.g., Computers in Teaching Mathematics, which was also published in 1982.

It seems as if every educational association is publishing its own introductory guide to educational computing. One example is Computers in Curriculum and Instruction (39), compiled by M. Tim Grady and Jane D. Gawronski, which is available from the Association for Supervision and Curriculum Development. Though not as cohesive as Coburn's book, since it consists of a series of articles written by various experts in the instructional field, it is very informative. A wide range of topics is covered in a very readable format, including computer literacy for students and teachers, the

selection of hardware and software, computer use in various subject areas, and issues and implications for the future. Judith Edwards-Allen's chapter on "Resources for Instructional Computing" provides an up-to-date annotated list of resources. Although the lack of an index limits access to specifics in the book, Computers in Curriculum and Instruction is on the whole a worthwhile introductory guide.

Run: Computer Education (40), edited by Dennis O. Harper and James H. Stewart, is different in format from the guides thus far discussed. It was specifically designed as a text or reference book for colleges of education or school districts offering computer literacy courses to preservice or inservice elementary and secondary teachers. An instructor's manual is included, as well as a series of exercises at the end of each section. Consisting of a set of readings on microcomputers in education, this book also lacks a certain cohesiveness. Harper and Stewart have, however, accomplished something worthwhile, i.e., they have pulled together in one source many key articles in the field of educational computing. The copyright date is misleading, since most of the articles included were published either in 1981 or earlier. Despite that fact, this book is a good introduction to many aspects of educational computing.

David Moursund, along with several other authors, has produced a series of introductory educational computing booklets that are available from the International Council for Computers in Education (11). One of the books, Moursund's Introduction to Computers in Education for Elementary and Middle School Teachers (41), revised and reprinted in 1982, can, like Coburn's book, be used by teachers at all levels. It provides a practical treatment of how to teach about computers and effectively utilize microcomputers in the classroom. Though less comprehensive than Coburn's book, it is unique because it provides teachers with over seventy-five classroom activities to teach about computers, including many that can be used even in schools without computers. Two interesting appendices are included: the first discusses calculators in education, and the second deals with pre-college computer literacy.

Another book worth mentioning is Adeline Naimon's Microcomputers in Education: An Introduction (42), published in January 1982 by the Northwest Regional Exchange and TERC. Naimon's book has a policies and planning orientation, and includes such topics as planning for microcomputers in the school; state

policies, practices and services; software/courseware selection and evaluation, including samples of evaluation forms; and a decision model for microcomputer purchasing. Though the book's index of resources is not annotated or as all-encompassing as others, it is well worth consulting.

Edited by Robert P. Taylor, The Computer in the School: Tutor, Tool, Tutee (43), 1980, is an important book in the field of instructional computing. Taylor has compiled nineteen essays written by five "pioneers" in the field: Alfred Bork, Thomas Dwyer, Arthur Luehrmann, Seymour Papert, and Patrick Suppes. Rather than being a how-to, practical guide, it emphasizes the basic issues and philosophies of educational computing. The role of computers in education at all levels is discussed, as well as the computer's potential and limitations. The three modes of computer applications presented are often cited in other sources; these modes are the role of the computer as tutor, tool, and tutee.

Edited by James L. Thomas, Microcomputers in the Schools (44) was one of the first books published in the field, and it is often cited in bibliographies. It includes twenty-five reprints of articles which appeared in journals predominantly in 1979 and 1980. Thomas has selected his articles well, and they provide an introduction to the world of educational computing. Unfortunately, they are brief and can only skim the surface of the topic. Like Harper and Stewart's book, the cohesiveness of the collection is limited since the articles were all pulled from journals and compiled for this publication. The appendices are useful, with the most comprehensive being those on funding sources for microcomputers in the schools and relevant organizations. A new revised edition may soon be available.

In all instances, the books thus far discussed paint a very rosy picture of the benefits of the use of microcomputers in the classroom. Henry Jay Becker's report, Microcomputers in the Classroom: Dreams and Realities (37), is a welcome addition to the literature since he discusses the field from a somewhat different perspective. Though Becker acknowledges that there are positive aspects of educational computing, he approaches the topic from a more cautionary viewpoint, discussing the problems and limitations that may be encountered. He urges much planning and thought as to how the microcomputer will actually be integrated into a curriculum before a school jumps on the bandwagon and begins to purchase

hardware and software. Becker's suggestions are practical and concrete. Anyone involved in the development of a microcomputer program for a school will find this publication thought-provoking and well worth reading.

More introductory guides are appearing monthly. By reading one or more of the educational computing journals (discussed in the periodicals section), one can keep abreast of such new publications as Joanne Johnson Troutner's book, The Media Specialist, the Microcomputer, and the Curriculum (45), which is due to be published in the fall of 1983.

RESOURCE GUIDES

The guides in the preceding section were books with actual information which provide an introduction to the field of microcomputers in education. This section will cover four recent publications that list print and nonprint resources in the field.

Computers and the Classroom--A Resource Guide (46), prepared by the Wisconsin Dissemination Project, was completed in October 1982. It is available through ERIC's index, Resources in Education (RIE). Though not comprehensive, this guide is one of the few available that has pulled together many of the journal articles, ERIC documents, books, and program descriptions, as well as organizations, periodicals, and newsletters in the field of educational computing. No subject index is provided, but the guide is divided into subject areas, and is broken down within each subject area by the type of information, i.e., journal articles, ERIC documents, books, and program descriptions, as mentioned above. Each entry is enhanced by a short abstract, with even the listings of organizations, magazines, newsletters, etc., being abstracted. Most of the citations are from 1981 or earlier with a few included from 1982. Even so, it is a very helpful source of recent information on instructional computing.

Microcomputers in Education: A Handbook of Resources (47), edited by Katherine Clay, was just published in December 1982. It is, again, one of the few resource guides available at this time. It is a "state of the art" resource guide with coverage from 1976 to the early part of 1982. Older citations are included selectively to

provide an overview of the field from 1976 to the present. Like the resource guide just discussed, it is divided into topics, e.g., Future/Trends, Computer Literacy, Philosophy, and References/ Resources. Clay has also pulled together many of the journal articles, microfiche/ERIC documents, and books written in the field of educational computing, and produced a valuable source of information. Each entry in her guide has either a short annotation, or, in the case of the ERIC documents, a longer abstract. Unlike the first resource guide discussed, this guide has a well-constructed subject index that increases accessibility to the information. Clay's appendices are also extremely useful and include such listings as periodicals, catalogs and directories, associations, software vendors, and a listing of user groups in education.

A third "resource guide," compiled by Gary Nave, Philip Browning, and Jeri Carter, is entitled Computer Technology for the Handicapped in Special Education and Rehabilitation: A Resource Guide (48). The title is misleading, since the guide is more a bibliography of journal articles, ERIC documents, conference proceedings, and other publications, than a comprehensive guide to resources. Microcomputer and mainframe computer applications are both covered. Each entry is annotated, and a well-constructed subject index is provided to increase access to the wealth of information found within. A listing of newsletters and journals can be located using the subject index. For those in special education, this resource guide is a valuable source to consult.

A fourth new resource guide which was not available for review at the time of publication is Microcomputers in Education: Resource Handbook (49), edited by Sharon Woodruff. Reviews of this source should soon be available.

DIRECTORIES

The Microcomputer Directory (50) and the 1983-84 Classroom Computer Learning Directory of Educational Computing Resources (Part A) (51) are two especially useful resources.

Revised in 1982, the Microcomputer Directory is a unique directory which describes schools and alternative settings that use

microcomputers for either instructional or administrative purposes. Over one thousand sites in the United States are included, with entries from elementary and secondary schools, computer camps, museums, prisons, alternative learning sites, and colleges and universities. Listings are by state and include a brief description of each program. There is also a subject index which provides an additional access point to the programs in the directory.

The 1983-84 Classroom Computer Learning Directory of Educational Computing Resources (Part A) is the best, most comprehensive resource directory available in the field, and is an invaluable reference tool. Part B, the Directory of Educational Software, not published until December of 1983, was not available for review.

Annual revisions of this directory will continually provide up-to-date information on educational computing. A wealth of information is found within, and most of the listings are annotated. Software and hardware resources are described, as well as books; magazines and newsletters; national, state and local educational computing organizations; funding sources, etc. It was disappointing to discover that the well-constructed subject index of last year's edition was missing this year, making it more difficult to locate information. Perhaps it will be reinstated next year. All in all, this directory is still relatively easy to use, and well worth acquiring by any educator involved with educational computing.

Software directories are plentiful, and will be discussed in the software section.

INDEXES AND ABSTRACTS

The field of instructional computing, as already stated, is a field which is changing constantly. The best way to keep up with the "state-of-the-art" is through the weekly, monthly, and quarterly periodicals. The following indexes and abstracts provide subject access to the myriad of articles being written today on educational computing as well as to books and documents.

The Education Index (57) provides references to articles and book reviews in education journals. A great deal of information on

instructional computing can be located using the subject headings "Microcomputers" and variations of the word "computer(s)," e.g., "Computer Literacy," "Computer Programming," "Computer Programs." The searcher should keep in mind that many relevant articles on microcomputers are indexed under headings other than "Microcomputers," as noted above. The main weakness of this index is that it only includes journals specifically concerned with education, even though there may be relevant articles on educational computing in non-education journals. It is also important to note that as of May 1983, the index still did not include any of the new education journals that are specifically concerned with educational computing such as Classroom Computer Learning, Electronic Learning, and The Computing Teacher, all of which are indexed in ERIC's Current Index to Journals in Education (CIJE), which will be discussed next. The Education Index provides the most comprehensive coverage of education periodicals, but many important articles will be missed unless other indexes are also consulted.

ERIC, mentioned in the clearinghouse section, produces two indexes that are extremely valuable sources of information on microcomputers in education. The Current Index to Journals in Education (CIJE) (56), like the Education Index, is an excellent source to use for locating journal articles. Again, using the subject headings "Microcomputers," and variations of the word "computer(s)," e.g., "Computer Literacy," "Computer Assisted Instruction," "Computer Simulations," many relevant citations can be found. CIJE's coverage of the field is somewhat broader than that of the Education Index. It covers many key educational computing journals not found in the Education Index, including Classroom Computer Learning, the Journal of Computers in Mathematics and Science Teaching, and Electronics Education. It also provides partial coverage of several more general microcomputing magazines such as Creative Computing. Another added feature is that each entry is annotated.

Resources in Education (RIE) (62), also produced by ERIC, is a unique abstracting service which indexes educational materials that are not accessible through any of the other indexes or abstracts. Most of the literature included is unpublished. Types of documents included vary, and some examples are as follows: research reports, directories, resource guides, bibliographies, conference proceedings, curricula, etc. RIE has a wealth of information on microcomputers that can be located using the subject headings "Microcomputers,"

"Computer-Assisted Instruction," "Computer Literacy," and other variations of the word "computer(s)." Its abstracts provide a good indication of the contents of each item. Most of the items cited in RIE are available on microfiche for a fee, or can be found in the ERIC microfiche collection in many larger libraries. Both CIJE and RIE are also searchable through online computer search services.

A third service, for anyone interested in special education, is Exceptional Child Education Resources (59). Using the subject headings "Microcomputers" and "Computers," information on educational computing can be located. Books, journal articles, nonprint professional media, and dissertations are abstracted.

Library Literature (60), an index to library periodicals, is another source of information, especially bibliographies. Relevant information can be located using the headings "Computers-Microcomputers" and "Computer Programs."

The Microcomputer Index (61) is the most important computer index for those interested in instructional computing. Available both in printed form and online, through Lockheed's Dialog system (see database section), it is one of the few indexing services that deal solely with information on microcomputers. Approximately thirty-eight periodicals are indexed, including many of the popular microcomputing magazines not indexed anywhere else. Not only articles are cited, but also book, hardware and software reviews, columns, and letters. Most of the key educational computing journals are included, as well as a few of the educational technology journals. Each entry also has a short abstract. Since this index deals only with microcomputers, subject headings that deal specifically with the level of education, area of interest, or type of information desired should be tried, e.g., "Elementary Education," "Bibliography," "Software Reviews/Education." This index, along with the Education Index, CIJE, and RIE are the four major abstracts and indexes to check for information on educational computing.

The following computer science indexes and abstracts are also worth noting: The ACM Guide to Computing Literature (52), Computing Reviews (53), COMPendium--"The Magazine of Computing Magazines" (58), Computer and Control Abstracts (54), and Computer Literature Index (55).

The ACM Guide to Computing Literature (52) and Computing Reviews (53) are both published by the Association of Computing Machinery. The first, The ACM Guide, is a listing of the major current computer literature. It is indexed by authors, titles, keywords, topics, sources, and reviewers, and includes all of the items reviewed and abstracted in Computing Reviews, as well as thousands of additional references to the current literature and books. It is published on an annual basis but the time lag is, unfortunately, two to three years, and the most recent guide available as of February 1983 was the 1980 edition. Computing Reviews, published monthly, provides reviews of current literature on computing. Articles, books, papers, reports, and other materials are indexed and abstracted. Items included are geared more to computer science professionals and others in the sciences than to teachers. Only a handful of items, if any, are included in each month's education section, and the index is awkward and hard to use effectively.

COMPendium--"The Magazine of Computer Magazines" (58) is a fairly new abstracting service. Each month entire issues of various microcomputing magazines are abstracted from cover to cover, i.e., every article, book review, hardware evaluation, and software review is listed, with a very brief description. It is different in format from the Microcomputer Index in several ways. Subject access is provided only in the December issue, and is not as detailed as in the Microcomputer Index. Not as many educational computing and educational technology journals are included in COMPendium. Both services provide much-needed access to the many microcomputing magazines now available. COMPendium can be purchased at some computer stores, and a sample is also available from the publishers upon request.

Computer and Control Abstracts (54), published monthly by the Institution of Electrical Engineers and the Institute of Electrical and Electronics Engineers, includes abstracts from a range of information sources such a bibliographies, journal articles, reports, books, dissertations, and conference papers and proceedings. It is international in scope, and is much more useful to the educator and school media specialist than the ACM publications. Relevant citations can be located using the subject headings "Educational Computing" and "Computer-Aided Instruction." This index complements the education indexes by including relevant information from some of the

popular microcomputing journals such as Microcomputing (formerly Kilobaud Microcomputing), Popular Computing, InfoWorld, and Softside. Since the subject index is published only twice a year, at other times of the year it is most effective to look in sections "78.10c-Computer Aided Instruction," and "71.10-Education/ Administrative Data Processing" for relevant information. The index provides access to conference proceedings and conference papers, which are not found in most of the other indexes and abstracts discussed.

The Computer Literature Index (55), formerly the Quarterly Bibliography of Computers and Data Processing (through 1979), is published quarterly, and indexes periodicals and books as well as conference reports. For the educator, it is the book coverage which is most useful, since it does not cover any of the key educational computing magazines or the popular microcomputing magazines. By checking the section on microcomputers one can learn about recent books published, including dictionaries, programming books, and popular microcomputing books. The subject headings "Microcomputers" and "Applications-Education" should both be checked when searching for information. Brief, noncritical annotations are included with each entry.

PERIODICALS

Periodicals are the best means of keeping up-to-date with the constant changes in the field. There are periodicals which deal specifically with educational computing, microcomputing magazines which often include sections or articles on educational applications and software, general education periodicals, publications of professional organizations which often include information on microcomputers, and specialized publications just on microcomputer hardware and software. With so many options available, it is hard to decide where to start! New educational computing magazines and newsletters are coming out in a steady stream, and most of them are announced in the educational computing magazines as they appear.

This review will concentrate on the key instructional computing periodicals. For a more complete listing of relevant microcomputing journals, the following recent annotated sources are extremely useful: "The Educator's Guide to Computer Periodicals," by Les R.

Dlabay, May 1982 (70), which discusses 34 periodicals; "An Annotated Bibliography of Microcomputer Periodicals," by Ronald A. Adams, Summer/Fall, 1982 (63), which describes 122 microcomputing periodicals, including newsletters (the author is planning to issue an updated version of this bibliography twice a year); "Microcomputer Periodicals for Libraries," by Karl Beiser, January 1983 (64), which includes 19 well-annotated entries as well as an additional unannotated listing of other more specialized and highly technical journals; and Coburn's section on periodicals in the Practical Guide to Computers in Education (38, pp. 242-247).

There are five key educational computing magazines for elementary and secondary school teachers and media specialists: Classroom Computer Learning (formerly Classroom Computer News) (65), The Computing Teacher (68), Educational Computer Magazine (71), Electronic Education (73), and Electronic Learning (74). All of the magazines include feature articles; columns; book, courseware, and software reviews; new product descriptions; and announcements of upcoming conferences. They are all practical, how-to magazines, rather than scholarly journals. Each magazine has its own unique format and monthly columns; some are much longer than others; some include many advertisements, others very few; some include more reviews than others. Electronic Education and Educational Computer Magazine cover all levels of education, while the others are mainly concerned with grades kindergarten through 12. It is recommended that each of them be previewed to determine which ones best fit individual needs.

All of the above journals are indexed by CIJE, and all except Electronic Education are in the Microcomputer Index, as of the summer 1983 issue.

There are numerous other subject-related periodicals dealing with instructional computing that are being published, including the following: Closing the Gap (66), Journal of Computers in Mathematics and Science Teaching (75), Computers, Reading and Language Arts (67), and Teaching and Computers (76).

Closing the Gap (66) is a bimonthly newsletter on microcomputer uses in special education. Each issue contains practical articles and reviews of microcomputer hardware and software, as well as conference announcements. Microcomputer applications pertaining

to a variety of handicapped individuals are discussed, including the deaf and hearing impaired, mentally handicapped, blind and visually impaired, learning disabled, severely physically handicapped, and others. Reasonably priced, it is well worth considering by anyone working with the handicapped. Closing the Gap now also sponsors one and two day workshops.

The Journal of Computers in Mathematics and Science Teaching (75), published quarterly, is geared to the use of computers (mainly microcomputers) for teaching mathematics and science at the pre-college and college levels. Feature articles, a software resources section, book reviews, annotated bibliographies, a new products section, and a calendar of conferences are included in every issue.

Computers, Reading and Language Arts (67) is a new quarterly journal which, judging from its premiere issue, will prove to be a valuable resource for both elementary and secondary school teachers interested in integrating microcomputers into their curriculum in the area of reading and language arts. Each issue will include feature articles on practical microcomputer applications; reviews of books, hardware, and software; abstracts of ERIC documents; and news of forthcoming conventions, conferences, new books, and software.

Lastly, another magazine to watch for is Teaching and Computers (76), which begins publication in fall 1983. Published by Scholastic, which also publishes Electronic Learning, Teaching and Computers will be the first magazine geared specifically to the elementary school classroom (K-6). It will include feature articles, reproducible student activities and lesson plans, and software reviews.

Of the journals just discussed, only the Journal of Computers in Mathematics and Science Teaching is indexed, and it is found in CIJE, the Microcomputer Index, and COMPendium.

All of the educational technology journals regularly include articles on microcomputers, as well as software and book reviews, and periodically have an issue devoted specifically to educational computing. Two such journals are Educational Technology (72) and the T.H.E. Journal (77). Both are indexed by CIJE, the Education Index, and the Microcomputer Index.

Many of the microcomputing magazines periodically include articles on microcomputers in education, as well as educational

software reviews. Creative Computing (69), for example, regularly includes information useful to teachers, and is indexed in the Microcomputer Index, CIJE, and COMPendium. To locate relevant information in the popular microcomputing magazines, the Microcomputer Index and COMPendium can be consulted.

It is important to note that some of the general education journals and journals for school media specialists are also now regularly including information on educational computing. For example, Instructor has had a "Computer Corner" in each issue since September 1982; the Journal of Learning Disabilities has had a section on computers in the schools in each issue since June/July 1982; Curriculum Review has had a "Computer Center" section since fall 1982; and School Library Journal also includes information on microcomputers, including software reviews, on a regular basis. All are indexed in the Education Index and CIJE. The School Library Journal (SLJ) is also indexed in Library Literature.

Journals dealing specifically with software and courseware review will be discussed in the software section.

DATABASES

Another means of locating information on microcomputers is through computerized databases. Many microcomputers, utilizing a modem (a device which facilitates communication between computers via phone lines) and a telephone, can gain access to online databases with their wealth of stored information. Doing a search online enables a searcher to locate information from a wide variety of periodicals, books, and other sources much more quickly and efficiently than in the printed sources of information. Search services are sometimes provided by school districts, intermediate education units, or state education agencies to teachers and other staff members in their districts. The ERIC Clearinghouses will also perform searches online for a fee. Though very effective and rapid, providing the most up-to-date information, online computer searching is relatively expensive. It would be wise to check with the school district to determine the feasibility and necessity for such searches.

Some of the indexes already discussed are also available online to institutions that subscribe to the services of the major commercial database vendors, i.e., Lockheed (DIALOG), the System Development Corporation (SDC), and the Bibliographic Retrieval Service (BRS). The Microcomputer Index and ERIC's database, which includes information from CIJE and RIE, are both available online, the first through DIALOG and ERIC through either DIALOG, BRS, or SDC.

The School Practices Information Network (SPIN), an online information network for educators, is available through BRS (1200 Route 7, Latham, NY 12110). SPIN contains more than one million documents from more than fifty databases, including ERIC, the School Practices Information File (SPIF), Exceptional Child Education Resources, Resources in Vocational Education, and Resources in Computer Education (RICE). "SPIN/SPIF represents the first attempt to facilitate the sharing of educational practice information among educational agencies and institutions through the use of advanced telecommunications and computer technology."[7]

RICE is a new online database which provides information on more than two thousand microcomputer courseware items. According to Judith Edwards-Allen, Director of the Computer Technology Program at the Northwest Regional Educational Laboratory where RICE was developed, it is the "most comprehensive database available on microcomputer software for use in elementary and secondary education." RICE has five files (sections). The first file, "Software Packages," contains descriptions and evaluations of over two thousand microcomputer software and courseware packages, though not all the items included have been evaluated. "Three other files were added in 1983: 'Computer Literacy,' containing objectives and test items for computer literacy teaching. . . ; 'Project Register,' containing descriptions of school projects involving K-12 computer applications; and 'Inventory,' containing actual numbers of student stations, and other data on the installation of hardware in schools" (Northwest Report, April-May 1982, Northwest Regional Educational Laboratory). For more information about the RICE database, contact the Northwest Regional Educational Laboratory (NWREL), 300 Southwest Sixth Avenue, Portland, OR 97204.

To learn more about online sources and databases the 1983-84 Classroom Computer Learning Directory (51), or Coburn's book, the Practical Guide to Computers in Education (38, pp. 216-218) can be consulted.

DICTIONARIES AND ENCYCLOPEDIAS

There still are not enough dictionaries available on microcomputing. Most of those that are available were published in about 1978 and are becoming outdated as new terms and acronyms appear each year. Some of the dictionaries include more educational computing terminology than others. Some are not geared for the novice, and care should be taken when choosing dictionaries for purchase. Many of the guides to microcomputers in education include glossaries which can be utilized.

Three dictionaries which might be helpful are as follows: Philip E. Burton's A Dictionary of Minicomputing and Microcomputing (78), 1982; Donald Spencer's Computer Dictionary (81), 1979; and James C. Palmer and Anita Y. Colby's Dictionary of Educational Acronyms, Abbreviations, and Initialisms (80), 1982.

Burton's A Dictionary of Minicomputing and Microcomputing (78) is one of the most comprehensive and up-to-date dictionaries available. It is the new, enlarged version of A Dictionary of Microcomputers by the same author. It is well-designed, and though it is not specifically geared to educational computing, it provides concise, nontechnical definitions of microcomputing and minicomputing terms, including a special glossary of Pascal terms. Spencer's Computer Dictionary (81) is a handy paperback of computing and microcomputing terms for the layman. The concise definitions are less technical even than Burton's. Spencer's coverage of terms is not as comprehensive or up-to-date as Burton's, but includes more educational computing terminology such as Logo and CMI.

Palmer and Colby's Dictionary of Educational Acronyms, Abbreviations, and Initialisms (80) is very up-to-date. This dictionary can be used to discover the long forms of many of the acronyms, abbreviations, and initialisms that pervade the educational computing literature. Either the abbreviated form can be looked up, or a second list of unabbreviated forms can be searched to confirm abbreviations. In a field with so many acronyms, this book is a welcome addition. Many educational computing terms are included such as MECC, MicroSIFT, and AEDS.

A new dictionary, the Illustrated Computer Science Dictionary for Young People (82), also by Donald Spencer, was published in 1982. Though I did not have an opportunity to review it, it may prove to be a useful resource. It is intended for grades four through eight, and includes easy to comprehend definitions and illustrations.

Most of the education encyclopedias and computer science encyclopedias are too outdated to be good sources of information on microcomputers in education. One exception is the Encyclopedia of Educational Research, 5th edition (79), published in 1982. This encyclopedia, with its well-constructed index, includes up-to-date information about microcomputers. Most of the information included, however, is available in the introductory guides to microcomputers in education, and it is not necessary to seek out an encyclopedia for information.

YEARBOOKS

The only two yearbooks that provide any real coverage of educational computing are the Educational Media Yearbook (83), and the World Yearbook of Education 1982/83 (84). For the "state-of-the-art" and latest developments in the field, the periodical literature is still the best place to look. The 1982 Educational Media Yearbook (83) is, however, a good source for other types of information. By looking up the term "Computers" in its subject index to organizations and associations, addresses and brief descriptions of computer-related groups can be found. There are other useful listings, including a section on "Media about Media," which has a list of computer-related books and periodicals for educators. In all instances the term "Computer" must be used, rather than "Microcomputers," to find relevant information. Subsequent editions of the yearbook will probably contain even more information as the educational computing field continues to grow.

The focus of the World Yearbook of Education 1982/83 (84), is "Computers and Education." Most of the resources discussed thus far have centered around developments here in the United States; however, this edition of the yearbook looks at the advances in the field from an international perspective. General issues and problems

are discussed by educators from around the world. For anyone interested in the international "state-of-the-art," this scholarly series of articles is a good place to start.

CONFERENCE PROCEEDINGS

Conference proceedings and papers from the educational computing and educational technology annual conferences can be another important source of information. Some proceedings can be found in ERIC's RIE (62), utilizing the term "Microcomputers" or the name of the association, e.g., NECC (National Educational Computing Conference), AEDS (Association for Educational Data Systems), and ADCIS (Association for the Development of Computer-based Instructional Systems). Associations will be found in the Institution Index.

Another source is the Directory of Published Proceedings. Series SSH: Social Sciences/Humanities (85), which is found in most university libraries. Using the index of key words from the conference titles and the sponsors' names, relevant conferences can be located using such terms as "Microcomputers," "Computer-Based Instruction," and "Educational Computing." Unlike RIE, which gives an abstract of the proceedings, this directory only gives ordering information, without any annotations.

BIOGRAPHICAL SOURCES

At the present time there is no information source which includes biographies of the prominent leaders in the field of educational computing. For some of the "pioneers" in the field, such as Seymour Papert and Patrick Suppes, a small amount of biographical information can be found in American Men and Women of Science, in the Physical and Biological Sciences volumes (86). In most instances, however, information must be gleaned from periodicals, book jackets, and other less traditional sources.

STATISTICAL SOURCES/GOVERNMENT DOCUMENTS

Besides ERIC, which is a government-sponsored system, the main type of government information available on educational computing is statistical. The National Center for Education Statistics (NCES), mentioned in the introduction, has conducted two surveys since 1980 on the number of computers found in the public schools. Reports of these surveys are being indexed in ERIC's RIE as they are published. The report on the first survey in the fall of 1980 came out in February 1982 (89). The surveys cover computer terminals connected to mainframe computers and microcomputers.

For information on congressional actions and legislation, consult the CIS Index (87), which indexes bills, reports, hearings, and laws passed by Congress, and the Congressional Quarterly Weekly Report (88), which contains a wealth of information about congressional and political activity for the current week. In these sources the progress of such bills as the Technology Education Act of 1982 can be checked. This bill would give a sizeable tax deduction to companies for donating computer and other technological equipment to elementary and secondary schools.

There are other private organizations that collect statistical information about microcomputers. For a partial list, consult Marilyn Laubacher's Microcomputers: Some Basic Resources (29).

HARDWARE INFORMATION RESOURCES

Microcomputer hardware is being refined constantly and it is very difficult to keep up with the latest advances. The most up-to-date, critical evaluations of hardware are usually found in the periodical literature. New product information is found in regular columns in nearly all microcomputing magazines. Using CIJE, the Education Index, and the Microcomputer Index, articles can be located on hardware selection and evaluation. The various guides and directories already discussed also contain information on hardware, such as criteria for hardware selection and listings of hardware manufacturers. Unfortunately, as Miller has said, "each of the articles comparing actual models and brands almost becomes obsolete by the time it is published,"[8] a fact which can be very frustrating.

The EPIE Institute (21), discussed in the resource center section, has set up an objective microcomputer product evaluation program. It produces Micro-Hardware PRO/FILES (95), in-depth critical evaluations of the major microcomputer hardware systems and related peripherals (equipment), such as printers, that are currently being used in the schools. Each PRO/FILE contains a photograph of the item; a physical description; laboratory test findings on the product's capability, performance, safety, durability, and ease of use; pricing; an evaluation of the operation manuals; and commentary from teachers and students. Every PRO/FILE is a separate two- to four-page write-up which can be conveniently filed. Updates of previously reviewed hardware will also be provided. Annual subscribers receive monthly PRO/FILE reports. EPIE also produces MICROgram, discussed in section II, "a monthly newsletter for educators in the tradition of Consumer Reports."[9]

In 1981 EPIE also published an EPIE equipment report entitled Microcomputer Hardware/Interactive Video Systems (92). Though the product descriptions are outdated, there is a very informative thirteen page introduction entitled "A Consumer's Guide to Microcomputer Hardware," which is worthwhile reading. The various components of microcomputers are discussed in very comprehensible language, complete with photographs.

The following is a sampling of some of the hardware selection articles and publications available.

In the March/April 1983 issue of Electronic Education, the "Annual Buyer's Guide" (90) includes a microcomputer comparison chart. "The Hardware Dilemma—Which System. . . and Why" (93, January 1983) takes the comparison one step further, and discusses twenty-four microcomputers used in education. Also included in this article is a series of "MicroGuides" which explore different topics related to the purchase of hardware.

Creative Computing Magazine's annual publication, the Creative Computing Buyer's Guide to Personal Computers (96), is another good microcomputer selection aid, as is the Microcomputer Reference: A Guide to Microcomputers (91), by Shirley Douglas and Gary Neights. The latter includes background information on microcomputers, criteria for evaluating microcomputers in relation to one's needs, and a series of extremely handy sample microcomputer comparison charts

that a prospective buyer can use to help determine which computer to buy. There is also a resource list at the end which is not completely up-to-date. Despite the latter weakness, this guide is extremely worthwhile for anyone involved in the purchasing of microcomputers for use in the schools.

Lastly, the periodical Info World (94) is a good source of hardware reviews. Though not specifically geared to educational computing, it discusses latest developments in microcomputers on a weekly basis.

SOFTWARE/COURSEWARE RESOURCES

The number of information resources available on educational software is enormous and increasing rapidly. An entire book could be written on this topic alone. An attempt will be made in this section to highlight some of the key sources of information.

There are certain issues to keep in mind when discussing educational software and courseware. First, hundreds of companies are now producing educational software/courseware. The problem lies in the fact that much of it is of poor quality. Teachers and school media specialists should be aware of this, and should learn how to evaluate the courseware now on the market, as well as become familiar with the sources of critical reviews of software. National clearinghouses for software information have been set up and computerized databases such as RICE have been developed to pull together educational software information.

INTRODUCTORY GUIDES TO EDUCATIONAL COURSEWARE

Ann Lathrop and Bobby Goodson's book, Courseware in the Classroom--Selecting, Organizing and Using Educational Software (98), published in March 1983, is a much-needed addition to the field. It is the first book to be published that deals solely with courseware, and it contains a wealth of information. Well-written and well-documented, it provides background information on the use of courseware in the classroom, all aspects of courseware evaluation, how to organize and catalog courseware, and a courseware section which contains listings in card catalog format. The appendices are

just as valuable, with copyright regulations, evaluation guidelines, sources of courseware reviews, a directory of courseware publishers, and policies and procedures for the selection of instructional materials. Unlike most books published in the field, this book will have annual supplements which will focus on new developments in instructional software, and will include an updated listing of new courseware. Also, unlike many of the other publications, it is reasonably priced.

Karen Jostad's article, "Search for Software" (97), published in the spring of 1982, is an informative introduction to the selection of commercial software, and includes a selected list of sources of courseware evaluations. Robert V. Price's article, "Selecting Free and Inexpensive Computer Software" (99), also published in the spring of 1982, is also extremely useful, especially since, as is well known, most educators work with limited budgets.

Also keep in mind that every guide to educational computing includes chapters on software selection and evaluation.

CATALOGS

There is a fine line between the terms "catalog" and "directory" as used by software companies. Catalogs will be defined here as either a listing of software from various publishers, which can be ordered directly from one specific source/distributor, or a listing of software all published by one publisher and available through that same publisher. Examples of catalogs with software from numerous publishers are K-12 MicroMedia (100), the Marck Catalog (101), and the Queue catalogs (103). Queue, Inc. is the oldest distributor of educational software, having published its first catalog in March 1980, and provides an extensive software selection. The MECC Instructional Computing Catalog (102), on the other hand, is an example of a catalog that only includes software developed by one publisher/producer. "Catalogs are intended to sell the products included therein,"[10] and do not contain evaluations of software. When choosing software distributors, look for those that have preview privileges or a 30-day return policy.

Some catalogs include only software, while others also include relevant books and/or hardware. Two annotated lists of educational

software catalogs that provide a good starting point are found in Coburn's Practical Guide to Computers in Education (38, pp. 233-235), and the 1983-84 Classroom Computer Learning Directory (51). Most catalogs can be requested free of charge.

SOFTWARE DIRECTORIES

Educational software directories list and describe available courseware from various publishers by one or more of the following criteria: subject area, programming language, grade level, and/or microcomputer type. They are designed to help one locate appropriate software, which must then be ordered from the manufacturer or a software distributor. It is important to note that most directories strive for comprehensiveness, rather than listing only software of high quality, and software is often included without being evaluated. There is usually no rating of the software listed, and, therefore, no way to distinguish between the excellent and the mediocre. Thus the use of directories may be a two-step process: first, software is identified which meets students' needs; then, software reviews/evaluations should be checked to see if the programs are worth purchasing, or, more effectively, the software should be previewed and evaluated personally. Some people do both, since even software with good reviews may not be appropriate for the students in their school. Once again, two up-to-date annotated lists of software directories are found in the 1983-84 Classroom Computer Learning Directory (51, pp. 27-30), and the Practical Guide to Computers in Education (38, pp. 231-233).

A new directory not mentioned in either of these two sources is Chartrand and Williams' Educational Software Directory--A Subject Guide to Microcomputer Software (104), published in November 1982. This directory lists software packages and programs for use in classrooms from kindergarten through grade 12. Programs included have not been evaluated, as usual, and the authors themselves state that not all of the programs included are of high quality. The subject index is well-designed and very detailed, providing excellent accessibility to the software included. It is this very detailed subject index that distinguishes this directory from others. The directory's annotated list of publishers and distributors also includes information about their previewing policies, which makes it a unique, extremely useful listing. Also included is an annotated bibliography of recent articles on software selection and evaluation.

Another example of a well-organized, worthwhile directory is the School Microware Directory (106), which is published twice a year in the fall and spring. It is a fairly comprehensive listing of educational software from over two hundred publishers, and includes both instructional and administrative software. Software is listed for the major microcomputers being used in the schools, and coverage is from kindergarten through grade 12. There are separate listings by subject and grade level and by hardware system, as well as a complete alphabetical listing by program name. As in Chartrand and Williams' directory, programs are listed without having been evaluated as to their quality. The publishers of School Microware Directory produce another publication which reviews software, entitled School Microware Reviews (120; discussed in software reviews section). It is regrettable that the two publications have not been combined.

A third example of an easy-to-use, comprehensive directory is Swift's 1982 Educational Software Directory: Apple II Edition (107). Finding educational software can be a chore, but, with the help of directories such as this one and the two just described, the process is becoming easier. Once again, software descriptions are provided covering kindergarten through grade 12. Again, the software listed has not been evaluated, but sometimes citations of software reviews are provided so that reviews can be located easily. Two indexes are included, one which lists each title alphabetically, and one which has a breakdown by discipline and grade level.

A brand new directory just published by TERC is entitled Software Finder: A Guide to Educational Microcomputer Software (105). It may prove to be another worthwhile resource.

SOFTWARE CLEARINGHOUSES

There is, as was already stated, a real need by teachers and school media specialists to be able to locate high quality software. Software clearinghouses are being set up which evaluate and sometimes even distribute software.

MicroSIFT (Microcomputer Software and Information for Teachers) (108), a project of the Computer Technology Program at the Northwest Regional Educational Laboratory (NWREL), is a clearinghouse for microcomputer-based software and courseware for

kindergarten through grade 12. "With the help of a twenty-six-member user network, MicroSIFT coordinates the systematic evaluation of educational courseware aimed at elementary and secondary classrooms. Results of evaluations have been placed in ERIC (see section on sources of software reviews--#115). Evaluations are also disseminated through some state departments of education and regional educational agencies, and are also available via the RICE database,"[11] as discussed in the database section. MicroSIFT has also developed a guide for the evaluation of software, which will be discussed in the section that follows. Their newsletter, MicroSIFT News, can be requested free of charge.

Softswap (109) is a joint project of the Microcomputer Center of San Mateo County's Office of Education and Computer-Using Educators, a large educators' user group in California. They collect and disseminate public domain software with educational applications. "The programs are available free of charge to educators who copy the programs at the Center. Further, Softswap operates as a software exchange. Any educator who contributes an original program on a disk may request any one Softswap disk in exchange. Softswap also sells disks (five to thirty programs per disk) for a nominal fee."[12]

For information on other software clearinghouses and cooperatives, check once again the Practical Guide to Computers in Education (38, pp. 237-238), and the 1983-84 Classroom Computer Learning Directory, (51, pp. 32, 34).

GUIDES TO THE EVALUATION OF SOFTWARE

If an educator decides to do his or her own evaluations of software and courseware, there are certain guidelines and procedures that should be followed. The Southwest Educational Development Laboratory and the Northeast Regional Exchange have just published the Evaluation of Educational Software--A Guide to Guides (110), a well-written, valuable resource for educators and school media specialists involved in the selection of software. The ten most prominent models for software evaluation are included, with brief summaries of each system and sample evaluation forms. The guide goes even further, raising key issues in the software selection process. A very informative article by Henry F. Olds is included,

entitled "Evaluating the Evaluation Schemes," as well as a lengthy, annotated up-to-date list of resources, including books, articles, directories, clearinghouses and information centers, software review periodicals, and computer accessible databases. Available for a very reasonable price, this guide is well worth acquiring.

Two well-written guides for evaluators included in the Guide to Guides are Guidelines for Evaluating Computerized Instructional Materials (111) and the Evaluators' Guide for Microcomputer-Based Instructional Packages (112).

Guidelines for Evaluating Computerized Instructional Materials (111) was published in 1981 by the National Council of Teachers of Mathematics. According to Lathrop and Goodson, it is a guide with "well-developed criteria, clear explanations, and evaluation forms which are simple and easy to complete. It can be used for any subject area, and is recommended for the novice."[13]

The Evaluators' Guide for Microcomputer-Based Instructional Packages (112), compiled by MicroSIFT in 1981, is a fairly comprehensive guide which includes background information, a detailed description of the evaluation process, and evaluation forms. The presentation is clear and thorough, and the guide is widely used.

SOURCES OF SOFTWARE REVIEWS

Reviews of educational software are found in a variety of publications. The best and most critical reviews are usually found in the periodical literature. Besides the periodicals discussed in the periodicals section, there is another whole genre of magazines that deal specifically with the review of software, such as Peelings II (118), which reviews Apple software. Also, "most magazines and journals dealing with microcomputers in education include software reviews on a fairly regular basis."[14]

The number of periodicals that are devoted primarily to software reviews is increasing constantly. For an annotated listing of the main software review sources consult either Lathrop and Goodson's book, Courseware in the Classroom (98, Appendix C); the Practical Guide to Computers in Education (38, pp. 235-237); the 1983-84 Classroom Computer Learning Directory, (51, pp. 32-34); or Evaluation of Educational Software: A Guide to Guides (110, pp. 86-87).

The following is a sampling of a few of the software review publications. Courseware Report Card (114), a new service begun in the fall of 1982, provides in-depth evaluations of educational microcomputer programs. A subscriber receives five issues a year, which consist of a series of reviews of programs for the Apple, TRS-80, Atari, and Commodore PET microcomputers. Each issue contains approximately 20 to 25 reviews for a total of over 100 program reviews per year. The reviews discuss performance, ease-of-use, documentation, educational value, error handling, and more. Each review is a self-contained 8½ by 11 inch report. There are two editions to choose from, one for K-6 programs, and the other for junior and senior high school, grades 7-12. The evaluations are well-written and critical, and both good and bad reviews will be included to help the educator with software selection. A few sample reviews will be provided upon request.

The EPIE Institute not only evaluates hardware, but software as well. Microcomputer Courseware PRO/FILES (117) are also in-depth evaluations like those of the Courseware Report Card, but they are a bit more expensive. The reviews are once again well-written and critical. Courseware/software is reviewed in all major curriculum areas and for all grade levels, kindergarten to 12. There are not two separate editions, by grade level, as in the Courseware Report Card. The reviews are published as four page pamphlets that can be alphabetized, or sorted as desired, and kept in a file box for easy reference. This is also a fairly new service, and more information about the number of reviews sent to a subscriber per year, etc., can be obtained by contacting the EPIE Institute.

School Microware Reviews (120) is another source of software/courseware reviews. Again, in-depth reviews are provided for software for the Apple, Atari, PET, and TRS-80 microcomputers. A subscription includes three issues per year. School Microware is different in format from the services just described. It is a publication in book form, rather than a series of self-contained reviews. Each issue includes about fifty reviews, covering all grades from kindergarten to grade 12, and most subject areas. A unique feature in each issue is an index to courseware reviews in many other publications. (Over 1,300 were listed in the Winter 1983 issue.) This index helps educators to locate reviews on software they may be interested in buying that has not been reviewed in School Microware Reviews. It even indicates the "tone" of each review as positive

negative, or neutral to help in deciding whether to explore an item further (an added feature in 1983).

Another source of software information very different from the above three is Software Review (121), which has been published since February 1982. Software Review is a journal with articles solely devoted to the topic of software and its educational and library applications. This journal does not contain critical, in-depth reviews of software, but rather features articles on software concepts, evaluation, and selection; descriptions of new software available; descriptions of new books published, including software directories and handbooks; and six to eight critical book reviews per issue. Each issue has a wealth of information. More expensive than the educational computing magazines, it would be advisable to preview this periodical before purchase to see if it is appropriate for one's information needs.

The Apple Journal of Courseware Review (113), formerly called the Journal of Courseware Review, is published irregularly by the Apple Education Foundation. Its aim is to publish in-depth critical reviews of high quality Apple courseware. Each issue has contained approximately fifteen lengthy reviews. The journal is not available at this time on a subscription basis, but it is available through Apple dealers as of spring 1983.

MicroSIFT Courseware Evaluations 1-87 (115) is the first series of evaluations compiled by MicroSIFT, and is available through ERIC. MicroSIFT's evaluations are not as critical as they could be, but are still worth consulting. Evaluations are based on the evaluation by three or more reviewers. Quarterly additions of twenty-five to thirty reviews are planned, and will be available through ERIC. They can be located by looking in RIE (62) under any of the following headings: "Computer Assisted Instruction," "Computer Programs," "Course Evaluation," or "MicroSIFT."

The Digest of Software Reviews: Education (116), edited by Ann Lathrop, is a new quarterly publication which premiered in the winter of 1983. The Digest is a unique, much-needed addition to the literature of educational courseware. The most frequently reviewed instructional courseware packages for students in grades kindergarten to 12 are highlighted, with fifty programs covered in each issue. The description of each program includes grade level and even cataloging

information, followed by a series of excerpts of reviews which originally appeared in the various education magazines. The programs are indexed by subject, title, microcomputer, and publisher, and the indexes will be updated with each issue to provide a cumulated index in each annual volume. Reviews are printed on single pages with three-ring holes for easy filing by title or subject. Well-organized and easy-to-use, the Digest has pulled together in one source coverage of a wide range of software, and should prove to be a valuable resource for anyone involved in courseware evaluation and selection.

School Courseware Journal (119), formerly called Courseware Magazine, does not fit neatly into any of the types of software resources covered, since it is a unique journal. Rather than providing reviews of software, this journal is in itself a source of educational software. Each issue contains a cassette or diskette with two programs for either the Apple, Pet, TRS-80, or Atari, according to one's subscription. Every program is accompanied by complete documentation, including a detailed teacher's guide and a student guide with worksheets. Programs included cover a variety of subjects and grade levels. To get a feel for the types of programs included in School Courseware Journal one can contact the publishers for a listing of back issues. Check reviews to determine the quality of their software.

TEXTBOOKS

Textbooks on computer literacy and computer programming are coming out in vast numbers; some are geared to teaching students and some to teaching teachers about computers. The latest El-Hi Textbooks in Print (125) is one place to look for information on textbooks. Relevant textbooks can be located by checking the "Computers and Electronics" section, and checking the title index for titles with the words "computers" or "microcomputers" as the first word. Unfortunately, El-Hi Textbooks in Print lists books with no descriptions, so it is really only a starting point.

Most microcomputer companies have student textbooks that accompany their hardware. Local microcomputer dealers may have more information about such publications.

"Computer Education—Texts and Supplements" (122), published in May 1982, is an extremely informative article which reviews computer textbooks for all grade levels, from kindergarten through 12. Lathrop's "Recommended Books for Elementary and Junior High School Library Media Centers" (35) is also helpful.

In general, the major textbook publishers have published computer-related textbooks, as have the publishers specializing in computer publications (see publishers section).

To learn about the latest textbooks being published, the book reviews and advertisements in such educational computing magazines as Electronic Learning should be perused on a regular basis.

Curriculum Review (124), a journal which publishes evaluations of textbooks, tradebooks, and supplementary materials in all areas of the K-12 curriculum, now includes a "Computer Center" section which reviews textbooks and software in each issue.

Several examples of recently published textbooks for teachers are as follows: George Culp and Herbert Nickles' An Apple for the Teacher: Fundamentals of Instructional Computing (123), 1983; Rachelle S. Heller and C. Diane Martin's Bits 'n Bytes About Computing: A Computer Literacy Primer (126), 1982; and Beverly Hunter's My Students Use Computers: Learning Activities for Computer Literacy (127), 1983.

An Apple for the Teacher: Fundamentals of Instructional Computing (123), is a practical book which teaches not only the fundamentals of the BASIC programming language for the Apple microcomputer, but also how to apply them to the design of instructional computing programs.

Bits 'n Bytes About Computing: A Computer Literacy Primer (126) is a very readable introduction to computers for teachers of grades kindergarten through eight. Each chapter includes student activities and related readings for student and teacher. One weakness of the text is the failure to indicate the reading or grade level of the related readings for students. This is just one of several computer literacy texts being published, so check out the options.

My Students Use Computers: Learning Activities for Computer Literacy (127) is an abbreviated version of My Students Use Computers: Computer Literacy in the K-8 Curriculum; both are available from Reston. This is one of the first texts published which outlines a complete computer literacy curriculum for grades K-8. Beverly Hunter, with the help of many, has developed a scope and sequence of computer literacy objectives designed to integrate computer use and activities into the regular K-8 curriculum. Detailed lesson plans are included as well as selected software and resources for classroom use. The lengthy appendix of resources is up-to-date, and includes an unannotated list of recommended books for teachers and administrators and for students; recommended periodicals; and directories of software.

Other unpublished computer literacy curricula can be found through ERIC's RIE by looking up "Computer Literacy."

POPULAR BOOKS AND NOTABLE BOOKS IN THE FIELD

The number of books being published on home computing, computer programming, microcomputers in education, and computer literacy, is overwhelming, and new ones are appearing each month. Refer to the bibliographies section for tips on how to learn about microcomputer books being published. Each of the guides to educational computing includes a listing of recommended microcomputer books in its bibliography section.

No discussion of instructional computing would be complete without recommending Seymour Papert's book, Mindstorms: Children, Computers, and Powerful Ideas, published in 1980 (128). Papert reports on his work with young children and the computer language Logo, and also discusses how computers will affect the way children think and learn. "Logo focuses on the thinking process and the intent of the language is to facilitate both children's thinking, and thinking about thinking."[15] Computers can be used as a powerful mind tool, and not just for drill and practice. Mindstorms is a speculative, thought-provoking book which should be on everyone's reading list.

EVALUATIVE ARTICLES--THE "STATE-OF-THE-ART"

The best method to learn about the "state-of-the-art" in microcomputers in education is to read one or more of the educational computing magazines on a regular basis. A few specific articles and chapters in books can also be consulted. Section IV on "Trends and Issues" in Thomas's book, Microcomputers in the Schools (44), and Gerald T. Gleason's article, "Microcomputers in Education: The State of the Art" (130), give some insight into the advances in educational computing up until 1981. More up-to-date information on the issues, problems, and advances in instructional computing is also provided in Coburn's Practical Guide to Computers in Education (38), Chapter One, "The Computer Goes to School," and Chapter Eight, "Issues and Choices in Educational Computing"; a series of articles in Today's Education (131), "Microcomputers in the Classroom," April/May 1982; Henry J. Becker's article, "Microcomputers: Dreams and Realities" (129), and "The Year in Review" (132), a special year-end report in Electronic Learning.

SOURCES OF BOOK REVIEWS

Books are reviewed in the educational computing journals, the general microcomputing magazines, the educational technology journals, the general education periodicals, and the library journals in their "Book Review" sections. By keeping up with the periodical literature one can keep up somewhat with many of the books being published. For book reviews on a specific book, consult the Microcomputer Index (61), the Education Index (57), the Book Review Digest (133), or the Book Review Index (134).

NONPRINT MATERIALS

Nonprint, i.e., audiovisual materials such as films and filmstrips, are available to help teach students about computers. Mandell's article, "Computer Literacy, Languages, and Careers" (135), April 1982, is an annotated list of over twenty-five audiovisual programs on computers. All grade levels are included, and most of the items included were produced in 1981 or 1982. This is one of the few articles written which highlights nonprint materials, and is an excellent source of information.

Additional sources for nonprint materials are the NICEM (National Information Center for Educational Media) Indexes, including the NICEM Index to 16 mm Educational Films (136) and the NICEM Index to 35 mm Educational Filmstrips (137). NICEM publishes a series of indexes on nonprint materials, including such media as overhead transparencies and videotapes, as well as a few subject indexes. Films or filmstrips can be located by looking in the "Industrial and Technical Education Section" of the film and filmstrip indexes mentioned above under the subheading "Electronics-Computers," and in the "Mathematics Section" under the subheading "Computers." In the 1980 editions, however, no films or filmstrips on computers newer than 1976 are included. More up-to-date ones should be listed in the new editions due out in 1983.

BOOK PUBLISHERS

Information on microcomputers in education appeared first in the periodical literature, but now almost all of the major publishers of school textbooks have published at least a few worthwhile microcomputing books for use by students, teachers, or school media specialists in the elementary or secondary schools. There are a number of publishers that have published a substantial number of microcomputer-related books and are especially worth noting, i.e., Computer Science Press, Inc., the dilithium Press, Addison-Wesley Publishing Company, Inc., Hayden Book Company, Inc., Osborne/McGraw-Hill, Inc., Reston Publishing Company, Inc., Sterling Swift Publishing Company, Sybex Inc., Tab Books, Inc., and John Wiley & Sons, Inc. Most of these companies have free catalogs of their computer and microcomputer books.

Addison-Wesley has begun publishing a series on "Computers in Education." The books in the series so far are all practical and very informative. Reston Publishing Company has also announced a new series of "Computers in Education" books and book/software packages which began publication in the spring of 1983. Ahl Computing, Incorporated, the publishers of Creative Computing, have also published a number of microcomputing books useful to educators; some are for children and some for adults. Other publishers to watch are Oryx Press and Libraries Unlimited, both of which publish many books in the field of education and library science, and have begun to publish books on educational computing.

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14. Naimon, Adeline. Microcomputers in Education: An Introduction. Cambridge, MA: Technical Education Research Center, Inc., 1982, p.52.

15. Thomas, James L. Microcomputers in the Schools. Phoenix, AZ: Oryx Press, 1981, p.148.

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The following is a listing of all items discussed in this book. Addresses of publications are provided for publishers not found in Books in Print.

Most ERIC documents with a six-digit ED number can be ordered from:

ERIC Document Reproduction Service
P. O. Box 190
Arlington, VA 22210

ERIC publications with a two-digit IR number can be ordered from:

Information Resources Publications
030 Huntington Hall
Syracuse University
Syracuse, NY 13210

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1. Logo Issue. Classroom Computer News, (April 1983), 3(5).

2. Logo Issue. BYTE, (August 1982), 7(8).

3. Lough, Tom. "Logo--Discovery Learning with the Classroom's Newest Pet." Electronic Learning, (March 1983), 2(6), 49-53.

4. ERIC Clearinghouse on Information Resources. Computer Literacy--An ERIC Fact Sheet. Syracuse, NY: Syracuse University, December 1982. 4pp.

5. Seidel, Robert J., Anderson, Ronald E. and Hunter, Beverly. Computer Literacy--Issues and Directions for 1985. New York: Academic Press, 1982. 308pp.

ASSOCIATIONS

6. Association for Computing Machinery/SIGCUE
   1133 Avenue of the Americas
   New York, NY 10036

7. Association for Computers in Mathematics and Science Teaching
   P. O. Box 4455
   Austin, TX 78765

8. Association for Educational Communications and Technology (AECT)
   1126 Sixteenth Street, N.W.
   Washington, DC 20036

9. Association for Educational Data Systems (AEDS)
   1201 Sixteenth Street, N.W.
   Washington, DC 20036

10. Association for the Development of Computer-Based Instructional Systems (ADCIS)
    Computer Center
    Western Washington University
    Bellingham, WA 98225

11. International Council for Computers in Education (ICCE)
    Department of Computer and Information Science
    University of Oregon
    Eugene, OR 97403

12. National Association for Educational Computing (NAEC)
    33 Knutsen Street
    Tappan, NY 10983

13. National Council of Teachers of English (NCTE)
    111 Kenyon Road
    Urbana, IL 61801

14. National Council of Teachers of Mathematics (NCTM)
    1906 Association Drive
    Reston, VA 22091

15. National Council of Social Studies (NCSS)
    3615 Wisconsin Avenue, N.W.
    Washington, DC 20016

16. National Science Teachers Association (NSTA)
1742 Connecticut Avenue, N.W.
Washington, DC 20009

17. Young People's Logo Association (YPLA)
1208 Hillsdale Drive
Richardson, TX 75081

RESOURCE CENTERS

18. Appalachia Educational Laboratory
P. O. Box 1348
Charleston, WV 25325

19. Northeast Regional Exchange
101 Mill Road
Chelmsford, MA 01824

20. Southwest Educational Development Laboratory
211 East Seventh Street
Austin, TX 78701

21. EPIE Institute
P. O. Box 620
Stony Brook, NY 11790

22. Minnesota Educational Computing Consortium-MECC
2520 Broadway Drive
St. Paul, MN 55113

23. Microcomputer Resource Center
Teachers College
Columbia University
New York, NY 10027

24. Technical Education Research Centers, Inc. (TERC)
Computer Resource Center
8 Eliot Street
Cambridge, MA 02138

USER GROUPS

25. "EI's Second Annual Survey of the States--State User Groups." Electronic Learning, (November/December 1982), 2(3), 62-71.

INFORMATION CLEARINGHOUSES

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4833 Rugby Ave., Suite 301
Bethesda, MD 20814

27. ERIC Clearinghouse on Information Resources (ERIC/IR)
Syracuse University
School of Education
030 Huntington Hall
Syracuse, NY 13210

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University of Illinois
College of Education
Urbana, IL 61801

31. National School Curriculum Center for Educational Computing
Iona College
715 North Avenue
New Rochelle, NY 10801

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